PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 501729 MDA	FOR FURTHER ACTION	See Form PCT/IPEA/416

International application No. **PCT/NZ2004/000121**	International filing date *(day/month/year)* 14 June 2004	Priority date *(day/month/year)* 13 June 2003

International Patent Classification (IPC) or national classification and IPC

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Applicant

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1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3   sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

   a. [X] *(sent to the applicant and to the International Bureau)* a total of 14 sheets, as follows:

   [X] sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

   [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. [ ] *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))   , containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4.   This report contains indications relating to the following items:

   [X] Box No. I   Basis of the report

   [ ] Box No. II   Priority

   [ ] Box No. III   Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

   [ ] Box No. IV   Lack of unity of invention

   [X] Box No. V   Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

   [ ] Box No. VI   Certain documents cited

   [ ] Box No. VII   Certain defects in the international application

   [ ] Box No. VIII   Certain observations on the international application

Date of submission of the demand 24 March 2005	Date of completion of the report 25 May 2005
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **J.W. THOMSON** Telephone No. (02) 6283 2214

Box No. I	Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

  ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:

    ☐ international search (under Rules 12.3 and 23.1 (b))

    ☐ publication of the international application (under Rule 12.4)

    ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

  ☐ the international application as originally filed/furnished

  ☒ the description:

      pages   **1-56** as originally filed/furnished

      pages*   received by this Authority on   with the letter of

      pages*   received by this Authority on   with the letter of

  ☒ the claims:

      pages   as originally filed/furnished

      pages*   as amended (together with any statement) under Article 19

      pages* **57-70** received by this Authority on **24 March 2005** with the letter of the same

      pages*   received by this Authority on   with the letter of

  ☒ the drawings:

      pages **1/19-19-19** as originally filed/furnished

      pages*   received by this Authority on   with the letter of

      pages*   received by this Authority on   with the letter of

  ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

    ☐ the description, pages

    ☐ the claims, Nos.

    ☐ the drawings, sheets/figs

    ☐ the sequence listing (*specify*):

    ☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

    ☐ the description, pages

    ☐ the claims, Nos.

    ☐ the drawings, sheets/figs

    ☐ the sequence listing (*specify*):

    ☐ any table(s) related to the sequence listing (*specify*):

*   *If item 4 applies, some or all of those sheets may be marked "superseded."*

Box No. V   Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.   Statement

Novelty (N)	Claims	1-39	**YES**
	Claims		**NO**
Inventive step (IS)	Claims	1-39	**YES**
	Claims		**NO**
Industrial applicability (IA)	Claims	1-39	**YES**
	Claims		**NO**

2.   Citations and explanations (Rule 70.7)

   D1: US 2002/0107821 A1

   D2: WO 01/20530 A1

   The invention defined by claims 1-39 is both novel an inventive in light of citations **D1** and **D2** as neither citation discloses the features of ordinal ranking and the identification of corollaries of explicitly resolved profile pairs.

CLAIMS

1. A decision support method comprising:

    for two or more pre-defined criteria, each criterion associated with one or more pre-defined and ordinally ranked categories, performing a comparative assessment of profiles each profile comprising a set of two or more of the criteria, each criterion in the set instantiated with one of the categories for that criterion, wherein the comparative assessment comprises the ordinal pairwise ranking of profile pairs, the ordinal pairwise ranking of profile pairs comprising the steps of:

    generating undominated profile pairs;

    presenting undominated profile pairs to a decision maker for ordinal pairwise ranking;

    receiving from the decision maker an ordinal ranking of the profiles in each profile pair presented; and

    identifying profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings performed and excluding them from subsequent presentation to the decision maker;

    the decision support method further comprising the step of:

    solving a system of equalities/inequalities that represents the ordinal pairwise rankings to obtain at least one ouput.

2. The decision support method of claim 1 wherein the at least one output comprises a point value for each category on each criterion.

3. The decision support method of claim 1 wherein the at least one output comprises a ranking of all possible profiles.

4. The decision support method of claim 1 wherein the at least one output comprises a ranking of a subset of all possible profiles.

5. The decision support method of claim 1 wherein the step of identifying profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings already performed and excluding them from subsequent

presentation to the decision maker comprises identifying all possible profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings already performed.

6. The decision support method of claim 1 wherein the step of generating undominated profile pairs comprises:

generating a set of undominated profile pairs with z criteria each, wherein z is greater than or equal to two and less than or equal to the number of possible criteria.

7. The decision support method of claim 6 wherein the ordinal ranking of profile pairs is repeated for at least one further value of z and wherein for any further value of z the step of generating a set of undominated profile pairs is followed by a step of excluding from the set any profile pairs that are pairwise ranked as corollaries of ordinal pairwise rankings performed for any previous value of z.

8. The decision support method of claim 6 or claim 7 wherein the step of generating a set of undominated profile pairs with z criteria each comprises the steps of:

forming all uninstantiated profiles with z criteria each by generating all unique subsets of the pre-defined criteria with z elements; and

for each uninstantiated profile formed, pairing it with a replica of itself to form an uninstantiated profile pair; and

instantiating the criteria of each uninstantiated profile pair with combinations of the pre-defined categories to form all unique undominated profile pairs with z criteria possible from the uninstantiated pair.

9. The decision support method of claim 8 wherein the step of instantiating the criteria of an uninstantiated profile pair comprises the steps of:

listing the numbers between 1 and $2^{z-1} - 1$ in binary form using z bits, and pairing each binary form with a further ordered z-tuple of bits, wherein each '0'

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or '1' of the further ordered z-tuple is the complement of each of the original z bits, to form $2^{z-1} - 1$ pairs of ordered z-tuples of bits; and

for each pair of ordered z-tuples of bits generating a copy of the uninstantiated profile pair and forming an undominated profile pair by instantiating each of the z criteria of a first profile in the pair according to the relative magnitudes of the bits in the first z-tuple and instantiating each of the z criteria of the second profile in the pair according to the relative magnitudes of the bits in the further z-tuple.

10. The decision support method of any one of claims 1 to 9 comprising the further step of excluding undominated profile pairs that are theoretically impossible.

11. The decision support method of any one of claims 1 to 10 wherein the step of generating undominated profile pairs comprises the further step of:

generating all possible undominated profile pairs that are consistent with a pre-defined subset of all possible profiles, and storing them on a temporary list;

and wherein the decision support method comprises the further steps of:

when an ordinal pairwise ranking of profile pairs is received from the decision maker, removing all members of the temporary list that are implicitly ordinally pairwise ranked as corollaries of any ordinal pairwise rankings of profile pairs already performed; and

when the temporary list is empty, solving the system of equalities/inequalities representing the ordinal pairwise rankings to rank the pre-defined subset of profiles.

12. The decision support method of any one of claims 1 to 10 wherein the step of generating undominated profile pairs comprises the further step of:

generating all possible undominated profile pairs that are consistent with a pre-defined subset of all possible profiles, and storing them on a temporary list;

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and wherein the decision support method comprises the further steps of:

when an ordinal pairwise ranking of profile pairs is received from the decision maker, removing all members of the temporary list that are implicitly ordinally pairwise ranked as corollaries of any ordinal pairwise rankings of profile pairs already performed; and

solving the system of equalities/inequalities representing the ordinal pairwise rankings to rank the pre-defined subset of profiles and designating profiles that cannot be ranked below any other profile as top-ranked profiles

wherein the process of ordinal pairwise ranking is halted once the temporary list contains no undominated profile pair for which one profile in the pair is one of the top-ranked profiles and the other profile in the pair is not a top-ranked profile; and the number of top-ranked profiles is less than or equal to a required number of top-ranked profiles.

13. The decision support method of claim 1 wherein the step of identifying undominated profile pairs that are implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed comprises repeating, for each undominated profile pair not yet presented to the decision maker, the steps of:

imposing a strict ordinal ranking of the profiles in the profile pair, and including the resulting inequality with the system of equalities/inequalities that represents the ordinal pairwise rankings of profile pairs already performed; and

testing the system of equalities/inequalities for the existence of a solution in terms of point values

wherein if a solution does not exist, then the profile pair is identified as implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed but wherein, if a solution does exist, then the method comprises the further steps of:

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for the same profile pair, imposing the reverse strict ordinal ranking of the profiles in the profile pair, and including the resulting inequality with the system of equalities/inequalities representing the ordinal pairwise rankings of profile pairs already performed; and

testing the system of equalities/inequalities for the existence of a solution in terms of point values

wherein if a solution does not exist, then the profile pair is identified as implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed, but wherein if a solution does exist, then the profile pair is identified as not implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed.

14. A decision support system comprising:
two or more pre-defined criteria stored in data memory, each criterion capable of being instantiated with one or more pre-defined and ordinally ranked categories; and
a processor programmed to perform a comparative assessment of profiles each profile comprising a set of two or more of the criteria, each criterion in the set instantiated with one of the categories for that criterion, wherein the comparative assessment comprises the ordinal pairwise ranking of profile pairs, the ordinal pairwise ranking of profile pairs comprising the steps of:

generating undominated profile pairs;

presenting undominated profile pairs to a decision maker on a display;

receiving from the decision maker via an input device an ordinal ranking of the profiles in each profile pair presented on the display; and

identifying profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings performed and excluding them from subsequent presentation to the decision maker;

the processor further programmed to solve a system of equalities/inequalities that represents the ordinal pairwise rankings to obtain at least one ouput.

15.   The decision support system of claim 14 wherein the at least one output comprises a point value for each category on each criterion.

16.   The decision support system of claim 14 wherein the at least one output comprises a ranking of all possible profiles.

17.   The decision support system of claim 14 wherein the at least one output comprises a ranking of a subset of all possible profiles.

18.   The decision support system of claim 14 wherein the step of identifying profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings already performed and excluding them from subsequent presentation to the decision maker comprises identifying all possible profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings already performed.

19.   The decision support system of claim 14 wherein the step of generating undominated profile pairs comprises:

        generating a set of undominated profile pairs with z criteria each, wherein z is greater than or equal to two and less than or equal to the number of possible criteria.

20.   The decision support system of claim 19 wherein the ordinal ranking of profile pairs is repeated for at least one further value of z and wherein for any further value of z the step of generating a set of undominated profile pairs is followed by a step of excluding from the set any profile pairs that are pairwise ranked as corollaries of ordinal pairwise rankings performed for any previous value of z.

21.   The decision support system of claim 19 or claim 20 wherein the step of generating a set of undominated profile pairs with z criteria each comprises the steps of:

        forming all uninstantiated profiles with z criteria each by generating all unique subsets of the pre-defined criteria with z elements; and

for each uninstantiated profile formed, pairing it with a replica of itself to form an uninstantiated profile pair; and

instantiating the criteria of each uninstantiated profile pair with combinations of the pre-defined categories to form all unique undominated profile pairs with z criteria possible from the uninstantiated pair.

22. The decision support system of claim 21 wherein the step of instantiating the criteria of an uninstantiated profile pair comprises the steps of:

listing the numbers between 1 and $2^{z-1} - 1$ in binary form using z bits, and pairing each binary form with a further ordered z-tuple of bits, wherein each '0' or '1' of the further ordered z-tuple is the complement of each of the original z bits, to form $2^{z-1} - 1$ pairs of ordered z-tuples of bits; and

for each pair of ordered z-tuples of bits generating a copy of the uninstantiated profile pair and forming an undominated profile pair by instantiating each of the z criteria of a first profile in the pair according to the relative magnitudes of the bits in the first z-tuple and instantiating each of the z criteria of the second profile in the pair according to the relative magnitudes of the bits in the further z-tuple.

23. The decision support system of any one of claims 14 to 22 wherein the processor is further programmed to perform the step of excluding undominated profile pairs that are theoretically impossible.

24. The decision support system of any one of claims 14 to 23 wherein the step of generating undominated profile pairs comprises the further step of:

generating all possible undominated profile pairs that are consistent with a pre-defined subset of all possible profiles, and storing them on a temporary list;

and wherein the processor is further programmed to perform the steps of:

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when an ordinal pairwise ranking of profile pairs is received from the decision maker, removing all members of the temporary list that are implicitly ordinally pairwise ranked as corollaries of any ordinal pairwise rankings of profile pairs already performed; and

when the temporary list is empty, solving the system of equalities/inequalities representing the ordinal pairwise rankings to rank the pre-defined subset of profiles.

25. The decision support system of any one of claims 14 to 23 wherein the step of generating undominated profile pairs comprises the further step of:

generating all possible undominated profile pairs that are consistent with a pre-defined subset of all possible profiles, and storing them on a temporary list;

and wherein the processor is further programmed to perform steps of:

when an ordinal pairwise ranking of profile pairs is received from the decision maker, removing all members of the temporary list that are implicitly ordinally pairwise ranked as corollaries of any ordinal pairwise rankings of profile pairs already performed; and

solving the system of equalities/inequalities representing the ordinal pairwise rankings to rank the pre-defined subset of profiles and designating profiles that cannot be ranked below any other profile as top-ranked profiles

wherein the process of ordinal pairwise ranking is halted once the temporary list contains no undominated profile pair for which one profile in the pair is one of the top-ranked profiles and the other profile in the pair is not a top-ranked profile; and the number of top-ranked profiles is less than or equal to a required number of top-ranked profiles.

26. The decision support system of claim 14 wherein the step of identifying undominated profile pairs that are implicitly ordinally pairwise ranked as a

corollary of ordinal pairwise rankings already performed comprises repeating, for each undominated profile pair not yet presented to the decision maker, the steps of:

imposing a strict ordinal ranking of the profiles in the profile pair, and including the resulting inequality with the system of equalities/inequalities that represents the ordinal pairwise rankings of profile pairs already performed; and

testing the system of equalities/inequalities for the existence of a solution in terms of point values

wherein if a solution does not exist, then the profile pair is identified as implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed but wherein, if a solution does exist, then the method comprises the further steps of:

for the same profile pair, imposing the reverse strict ordinal ranking of the profiles in the profile pair, and including the resulting inequality with the system of equalities/inequalities representing the ordinal pairwise rankings of profile pairs already performed; and

testing the system of equalities/inequalities for the existence of a solution in terms of point values

wherein if a solution does not exist, then the profile pair is identified as implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed, but wherein if a solution does exist, then the profile pair is identified as not implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed.

27. A decision support computer program comprising:
for two or more pre-defined criteria stored in data memory, each criterion capable of being instantiated with one or more pre-defined and ordinally ranked categories, computer executable instructions for performing a comparative assessment of profiles each profile comprising a set of two or more of the criteria, each criterion in the set instantiated with one of the categories for that criterion, wherein the

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comparative assessment comprises the ordinal pairwise ranking of profile pairs, the ordinal pairwise ranking of profile pairs comprising the steps of:

generating undominated profile pairs;

presenting undominated profile pairs to a decision maker on a display;

receiving from the decision maker via an input device an ordinal ranking of the profiles in each profile pair presented on the display; and

identifying profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings performed and excluding them from subsequent presentation to the decision maker;

the decision support computer program further comprising computer executable instructions for solving a system of equalities/inequalities that represents the ordinal pairwise rankings to obtain at least one ouput.

28. The decision support computer program of claim 27 wherein the at least one output comprises a point value for each category on each criterion.

29. The decision support computer program of claim 27 wherein the at least one output comprises a ranking of all possible profiles.

30. The decision support computer program of claim 27 wherein the at least one output comprises a ranking of a subset of all possible profiles.

31. The decision support computer program of claim 27 wherein the step of identifying profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings already performed and excluding them from subsequent presentation to the decision maker comprises identifying all possible profile pairs that are implicitly ordinally pairwise ranked as corollaries of ordinal pairwise rankings already performed.

32. The decision support computer program of claim 27 wherein the step of generating undominated profile pairs comprises:

generating a set of undominated profile pairs with z criteria each, wherein z is greater than or equal to two and less than or equal to the number of possible criteria.

33. The decision support computer program of claim 32 wherein the ordinal ranking of profile pairs is repeated for at least one further value of z and wherein for any further value of z the step of generating a set of undominated profile pairs is followed by a step of excluding from the set any profile pairs that are pairwise ranked as corollaries of ordinal pairwise rankings performed for any previous value of z.

34. The decision support computer program of claim 32 or claim 33 wherein the step of generating a set of undominated profile pairs with z criteria each comprises the steps of:

    forming all uninstantiated profiles with z criteria each by generating all unique subsets of the pre-defined criteria with z elements; and

    for each uninstantiated profile formed, pairing it with a replica of itself to form an uninstantiated profile pair; and

    instantiating the criteria of each uninstantiated profile pair with combinations of the pre-defined categories to form all unique undominated profile pairs with z criteria possible from the uninstantiated pair.

35. The decision support computer program of claim 34 wherein the step of instantiating the criteria of an uninstantiated profile pair comprises the steps of:

    listing the numbers between 1 and $2^{z-1} - 1$ in binary form using z bits, and pairing each binary form with a further ordered z-tuple of bits, wherein each '0' or '1' of the further ordered z-tuple is the complement of each of the original z bits, to form $2^{z-1} - 1$ pairs of ordered z-tuples of bits; and

    for each pair of ordered z-tuples of bits generating a copy of the uninstantiated profile pair and forming an undominated profile pair by instantiating each of the z criteria of a first profile in the pair according to the relative magnitudes of the bits in the first z-tuple and instantiating each of the z criteria of the second

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profile in the pair according to the relative magnitudes of the bits in the further z-tuple.

36. The decision support computer program of any one of claims 27 to 35 further comprising computer executable instructions to perform the further step of excluding undominated profile pairs that are theoretically impossible.

37. The decision support computer program of any one of claims 27 to 36 wherein the step of generating undominated profile pairs comprises the further step of:

generating all possible undominated profile pairs that are consistent with a pre-defined subset of all possible profiles, and storing them on a temporary list;

and wherein the computer program comprises computer executable instructions to perform the further steps of:

when an ordinal pairwise ranking of profile pairs is received from the decision maker, removing all members of the temporary list that are implicitly ordinally pairwise ranked as corollaries of any ordinal pairwise rankings of profile pairs already performed; and

when the temporary list is empty, solving the system of equalities/inequalities representing the ordinal pairwise rankings to rank the pre-defined subset of profiles.

38. The decision support computer program of any one of claims 27 to 36 wherein the step of generating undominated profile pairs comprises the further step of:

generating all possible undominated profile pairs that are consistent with a pre-defined subset of all possible profiles, and storing them on a temporary list;

and wherein computer program comprises computer executable instructions to perform the further steps of:

when an ordinal pairwise ranking of profile pairs is received from the decision maker, removing all members of the temporary list that are implicitly ordinally

pairwise ranked as corollaries of any ordinal pairwise rankings of profile pairs already performed; and

solving the system of equalities/inequalities representing the ordinal pairwise rankings to rank the pre-defined subset of profiles and designating profiles that cannot be ranked below any other profile as top-ranked profiles

wherein the process of ordinal pairwise ranking is halted once the temporary list contains no undominated profile pair for which one profile in the pair is one of the top-ranked profiles and the other profile in the pair is not a top-ranked profile; and the number of top-ranked profiles is less than or equal to a required number of top-ranked profiles.

39. The decision support computer program of claim 27 wherein the step of identifying undominated profile pairs that are implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed comprises repeating, for each undominated profile pair not yet presented to the decision maker, the steps of:

imposing a strict ordinal ranking of the profiles in the profile pair, and including the resulting inequality with the system of equalities/inequalities that represents the ordinal pairwise rankings of profile pairs already performed; and

testing the system of equalities/inequalities for the existence of a solution in terms of point values

wherein if a solution does not exist, then the profile pair is identified as implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed but wherein, if a solution does exist, then the method comprises the further steps of:

for the same profile pair, imposing the reverse strict ordinal ranking of the profiles in the profile pair, and including the resulting inequality with the system of equalities/inequalities representing the ordinal pairwise rankings of profile pairs already performed; and

testing the system of equalities/inequalities for the existence of a solution in terms of point values

wherein if a solution does not exist, then the profile pair is identified as implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed, but wherein if a solution does exist, then the profile pair is identified as not implicitly ordinally pairwise ranked as a corollary of ordinal pairwise rankings already performed.

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TOTAL P.22